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SENSORY CONSEQUENCES OF ELECTROLOCATION BEHAVIORS IN
GYMNOTIFORM WEAKLY ELECTRIC FISH

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Weakly electric fish exhibit characteristic probing movements while exploring objects using electrolocation. These behaviors suggest that the fish actively control their body movements to optimize sensory data acquisition. To examine the sensory consequences of electrolocation behaviors, we built a 3-D model of the fish body, simulated the electric organ discharge from videotaped behaviors, and used the simulated electrosensory image as input to a simple model of adaptive filtering in the electrosensory lateral line lobe (ELL). The fish model was first applied to analyze "tail probing" in *Eigenmannia*, in which the fish bends its tail towards an object while translating its body slightly backwards. The analysis suggests that the translation component is specifically designed to stabilize the object image pattern on the fish's rostral surface. We next modeled a tail-first "cartwheel scan" behavior in *Apteronotus*, in which the fish holds its body in a rigid arc while swinging in a circle around the object. The simulation shows that by holding a fixed arc, the fish minimizes changes in electrosensory reafference due to body motion that would interfere with the object image. The simulated electrosensory stimuli were input to an ELL principal cell model which included descending inputs and anti-Hebbian synaptic learning. The ELL model was first trained to predict and suppress electrosensory reafference resulting from tail bending alone. After training, the ELL circuit can separate and extract the object image from reafference due to body motions.

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